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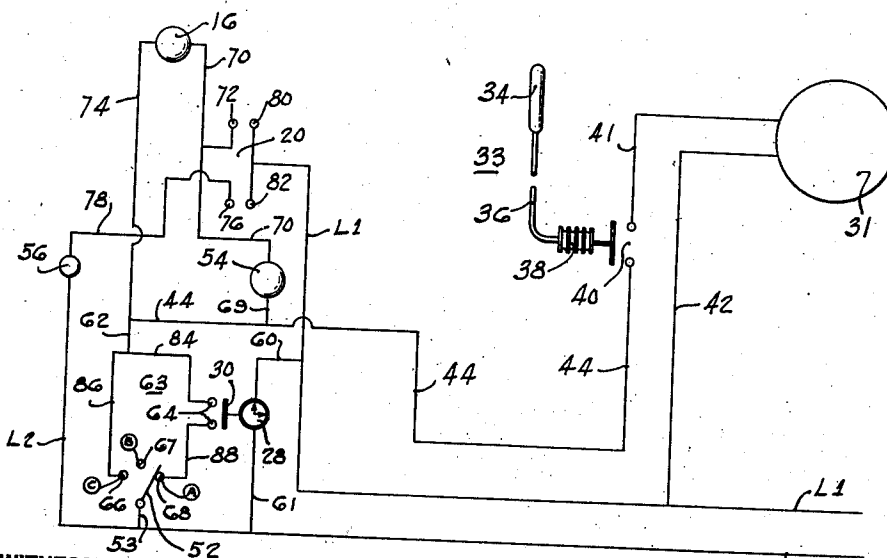
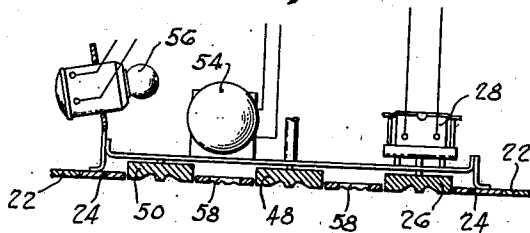
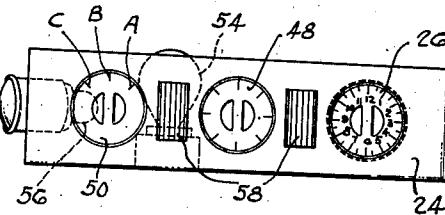


Fig. 2

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REFRIGERATION APPARATUS

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My invention relates to refrigerating apparatus and has for an object to produce an improved visual signalling system for indicating whether or not the refrigerating mechanism is set for defrosting, as well as for indicating damage in the circuit of the refrigerator or power failure in the service lines which supply current to the refrigerator.

A still further object of my invention is to produce an improved signalling system of the character set forth, which is concealed from view when the refrigerator door is closed, and which is rendered visible and is operated by the opening of the refrigerator door.

A still further object of my invention is to produce a simplified mechanism of the type set forth which may be placed in a position for automatic or for manual operation, or which may be rendered altogether inactive by the manipulation of a single switch from one designated position to another.

A still further object of my invention is to produce an improved electric circuit for energizing the signalling system and the defrosting control mechanism in cooperation with the refrigeration apparatus itself and the standard temperature control thereof.

These and other objects are effected by my invention as will be apparent from the following description and claims taken in connection with the accompanying drawing, forming a part of this application, in which:

Fig. 1 is a front elevational view of a refrigerator embodying my invention;

Fig. 2 is a diagrammatic view showing a preferred form of an electric circuit for carrying out my invention;

Fig. 3 is an enlarged view of an instrument panel on which control devices are mounted; and

Fig. 4 is a view partly in top plan and partly in horizontal section of the panel shown in Fig. 3.

Referring now to the drawing in detail and more particularly to Figs. 1, 3, and 4, I show a refrigerator 10 having a food compartment 12, a heat exchange unit 14, a lamp 16, and a door 18. The lamp 16 is normally energized by an automatic switch 20 when the door 18 is opened, to illuminate the food compartment 12.

At a suitable location, which would be concealed when the door 18 is closed, such as the bottom wall 22, there is mounted a panel 24 which carries a graduated dial 26 for setting an automatic circuit-breaking and making clock mechanism 28. The clock mechanism 28 may be of any well-known design and it is therefore not

shown nor described in detail, it being sufficient to state that at stated intervals to which it may be set, it actuates a switch 30 (Fig. 2) to deenergize the refrigerating apparatus 31 for a predetermined period of time to allow the unit 14 to be defrosted. When the period of time to which it is set expires, the clock mechanism 28 again actuates the switch 30 to set the refrigerating apparatus in operation in order to bring the unit 14 back to its normal temperature which is below freezing. The action of the clock mechanism 28 is independent of, and is in addition to, the normal operation of the conventional temperature control with which conventional refrigerators are provided. For the purpose of completing the illustration of the present invention, I show in a very diagrammatic manner a temperature control 33 including a bulb 34 connected by a tube 36 to a bellows 38 which actuates a switch 40. As shown in Fig. 2, one side of the switch 40 is connected by a wire 41 to one side of the refrigerating apparatus 31, the other side of which is connected by a wire 42 to one side L₁ of a power supply circuit. The other side of the switch 40 is connected by a wire 44, and other intermediate circuits to be later on described, to L₂ of the power supply circuit.

The panel 24 also carries a graduated dial 48 which is operatively connected to the temperature control 33 so that the average temperature in the unit 14 is maintained at the degree to which the dial 48 is set. This control mechanism is also conventional and is therefore not shown nor described in detail. Also mounted on the panel 24 is a dial 50 which is used to actuate a three-way switch 52 (Fig. 2) which is connected to the lead L₂ by a wire 53 and which will be hereinafter further described.

In proximity to the dials 26, 48 and 50, and preferably carried by the panel 24, are a relatively strong lamp 54 and a relatively weak signal lamp 56. The lamp 54 is preferably white and the lamp 56 is of a different color, such as red. The panel 24 may be made of translucent material or it may be provided with transparent or translucent windows 58 to transmit light from the lamp 54 to illuminate the dials 26, 48 and 50, and to make the signal lamp 56 visible when the lamp 54 is deenergized. Alternately, the dials 26, 48 and 50 may themselves be made of translucent material.

For a description of the manner in which the elements above described are cooperatively interrelated, attention is directed to Fig. 2 in which a preferred form of circuit is illustrated.

Beginning with the clock mechanism 28, it will be seen that it is connected directly to the leads L₁ and L₂ by the wires 60 and 61 so that as long as the power supply circuit is energized, the clock mechanism 28 will remain in operation to actuate the switch 30 regardless of any other adjustments or settings of the remaining parts of the apparatus.

Referring now to the switch 40, it will be seen that it is connected through the wires 44 and 62 to a switching device 63. The switching device 63 has terminals 64 which coact with the terminal of the switch 30, and terminals 66, 67 and 68 which coact with the terminal of the switch 52.

The panel lamp 54 is connected to the wire 44 by a wire 69 and is connected by a wire 70 to a terminal 72 of the switch 20 which, as will be seen from Fig. 2, is of the double acting type.

The wire 70 also leads to one side of the food compartment lamp 16, the other side of said lamp being connected by a wire 74 to the wire 44. The lamps 54 and 16 are therefore connected in parallel with one another and in series to the switching device 63 through the wire 62.

The other terminal 76 of the switch 20 is connected through a wire 78 to one side of the signal lamp 56, the other side of which is connected directly to the lead L₂ of the power supply circuit.

The switch 20 also includes terminals 80 and 82 which are normally separated from the terminals 72 and 76 when the door 18 is closed, and which are urged into contact with the terminals 72 and 76 when the door 20 is opened. The terminals 80 and 82 are connected directly to the lead L₁ of the supply circuit. The wire 62 is connected to one of the terminals 64 of the switching device 63 by a wire 84, and to the terminal 66 of the switch 52 by a wire 86. The other terminal 64 is connected to the terminal 68 of the switch 52 by a wire 88.

Operation

With the clock mechanism 28 in non-defrosting position so that the switch 30 is in contact with the terminals 64 and with the switch 52 in position A, which on the dial 50 is marked "automatic defrost," the wires 62 and 44 are electrically connected, through the wires 84, 88, and 53, to the lead L₂. In this position of the parts, the refrigerating apparatus 31 will operate subject to the opening and closing of the switch 40 by the temperature control 33 in response to changes in temperature of the unit 14. In this position of the parts, also, and when the clock mechanism has arrived at defrosting position, which is determined by the setting of the dial 26, the switch 30 is opened (see Fig. 2) and the wires 62 and 44 are electrically disconnected from the lead L₂, thus interrupting the circuit of the refrigerating apparatus 31, which will remain inactive, regardless of the position of the switch 40, until the predetermined period of time to which the clock mechanism 28 has been set shall have expired. When the clock mechanism 28 has again closed the switch 30, the refrigerating apparatus 31 will again be in operation, due to the fact that the high temperature in the unit 14 will have also closed the switch 40. The length of time through which the refrigerating apparatus will remain inactive is determined by the setting of the defrosting clock according to the particular requirement of the unit, or the location in which the unit is used, and it is only pointed out here that this length of time should be enough to per-

mit melting of any frost accumulating on the unit 14.

Again, with the parts still in the position described but with the switch 30 closed, and regardless whether the refrigerating apparatus is in operation or not, it will be seen that, when the refrigerator door 18 is opened the switch 20 is closed and the circuit of the lamps 16 and 54 is completed through the terminals 80 and 72, the wires 70, 74, 62, 84, 88, 44 and 53, and the lamps 16 and 54 will be energized. If, with the parts still in the same position but with the switch 30 open, due to the action of the clock mechanism 28 the door 18 is opened, the lamps 16 and 54 will obviously not be energized. This will indicate that the unit 14 is being defrosted. In order to indicate power failure, either in the supply circuit L₁, L₂ or in the refrigerating apparatus circuit itself, which would render the apparatus 31 inactive and would also deenergize the lamps 16 and 54, but which failure may not be detected in good time, I provide the auxiliary signal lamp 56 which is connected directly to the supply circuit L₁, L₂ through terminals 82 and 76 so that, as long as the lamp 56 is in order and as long as there is power in the supply circuit L₁, L₂, and as long as the internal circuit of the refrigerator circuit is in order, the lamp 56 will be energized whenever the door 18 is opened and regardless of the position of the switch 30, of the clock mechanism 28, or the switch 52. The function of the signal lamp 56 is to prevent damage to food stored in the refrigerator which would result from prolonged, undetected failure of the refrigerator apparatus.

If the switch 52 is moved to position B which, on the dial 50, is marked "manual defrost," it follows that the circuit 63 is disconnected from the lead L₂ so that the switching device of the refrigerating apparatus 31 is also broken. This will render the apparatus 31 inactive and will also deenergize the lamps 16 and 54, regardless of the position of the switch 30. If the switch 52 is moved to position C, which on the dial 50 is marked "no defrost," it will be seen that the switching device 63 will be connected through the wires 86 and 53 to the lead L₂, and, since the refrigerating apparatus 31 is connected by the wire 42 to the lead L₁, and by the wires 44 and 62 to the switching device 63, the circuit of the refrigerating apparatus 31 will remain closed, regardless of the position of the switch 30 of clock mechanism 28. The refrigerating apparatus 31 now operates only subject to the position of the switch 40, as determined by the temperature control 33. This position of the parts is desirable when continuous refrigeration is needed for freezing ice cream or the like in the unit 14. Also, in this position of the parts, when the door 18 is opened the circuit of the lights 16 and 54 will be closed through the wires 62, 86 and 53, and the lights will be energized.

The lamps 56 and 54 are so placed in relation to the dials 26, 48 and 50 so that these dials are normally illuminated by the lamp 54, and the relatively weak light from the small, and preferably red, lamp 56 will be dominated by the relatively strong light from the large lamp 54 so as to be substantially invisible when the lamp 54 is energized. When the lamp 54 is deenergized during the defrosting cycle, the light from the lamp 56 will be visible so as to indicate that the power supply is in order, but that the unit 14 is being defrosted.

It will thus be seen that my invention provides

a dual signal system which visually indicates whether or not the refrigerating unit is being defrosted, and whether or not the power supply is in order. Also, the failure of the light 16 or 54 to be deenergized, during a period for which the clock mechanism is set to defrosting position, will clearly indicate a failure in the clock mechanism 28 or its circuit. It will also be seen that another important feature of my invention is the provision of the three-way switch 52 which affords the user complete control inasmuch as it may be set to "automatic defrosting" when it is desired to control the defrosting cycle by the clock mechanism, to "manual defrosting" if such defrosting be needed prior to its expected occurrence through action of the clock mechanism 28, and to a non-defrosting position so as to guard against spoilage and to permit uninterrupted refrigeration when it is desired.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What I claim is:

1. The combination with a refrigerator having a food compartment, a lamp therein for illuminating said compartment, means for normally energizing said lamp when the door of said refrigerator is opened, a heat-exchange unit for said food compartment, refrigerating means for maintaining said unit at below freezing temperature, and means for periodically rendering said refrigerating apparatus inactive to allow defrosting of said unit, of means for preventing the energizing of said lamp when said door is opened while said refrigerating means is inactive, to indicate that said unit is being defrosted.
2. The combination with a refrigerator having a food compartment, a lamp therein for illuminating said compartment, a panel on which control devices are mounted, a lamp for illuminating said control devices, means for normally energizing both of said lamps when the door of said refrigerator is opened, a heat-exchange unit for cooling said food compartment, refrigerating means for maintaining said unit at below freezing temperature, and means for periodically rendering said refrigerating apparatus inactive to allow defrosting of said unit, of means for preventing the energization of both of said lamps when said door is opened while said refrigerating means is inactive, to indicate that said unit is being defrosted.
3. The combination with a refrigerator having a food compartment, a lamp therein for illuminating said compartment, a panel on which control devices are mounted, a second lamp for illuminating said control devices, an auxiliary signal lamp in proximity to said panel, means for

energizing all of said lamps when the door of said refrigerator is opened, a heat-exchange unit for cooling said food compartment, refrigerating means for maintaining said unit at below freezing temperature, and means for periodically rendering said refrigerating apparatus inactive to allow defrosting of said unit, of means for preventing the energization of said first and second mentioned lamps when said door is opened while said refrigerating means is inactive, the lack of energization of said first and second mentioned lamps indicating that said unit is being defrosted, and the energization of said signal lamp indicating that the electric circuit supplying power to said refrigerator is energized.

4. The structure recited in claim 3 wherein the light from said signal lamp is weaker than the light from said second lamp whereby the light from said signal lamp is dominated by the light from said second lamp and is substantially invisible when said second lamp is energized.

5. The structure recited in claim 3 wherein said signal lamp is of a color different from the color of said second lamp and the light from said signal lamp is also weaker than the light from said second lamp whereby the light from said signal lamp is dominated by the light from said second lamp and is substantially invisible when said second lamp is energized.

6. In a mechanical refrigerator, the combination of a cabinet, a door for said cabinet, electrically-driven refrigerating apparatus, said apparatus including a cooling unit maintained at below freezing temperature for abstracting heat from the interior of said cabinet, supply lines for supplying electric power to said refrigerating apparatus, a defrost switch for interrupting the electric current to said refrigerating apparatus to allow said cooling unit to defrost, a second switch actuated by said door to open when said door is closed and to close when said door is opened, an electric signal lamp, electric conductors connecting said signal lamp and second switch in series to said supply lines to energize said lamp only when said door is open, a second signal lamp, and electric conductors connecting said second signal lamp and both of said switches in series to said supply lines to energize said second signal lamp only when the door is open and when said refrigerating apparatus is not defrosting, both of said lamps being extinguished when said door is closed, whereby when said door is opened, lighting of both of said signal lamps indicates that the refrigerating apparatus is not defrosting, lighting of only said first signal lamp indicates that the refrigerating apparatus is not operating because of the opening of said defrost switch and the failure of both of said signal lamps to light indicates that the refrigerating apparatus is not operating because of a failure of power to said supply lines.

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